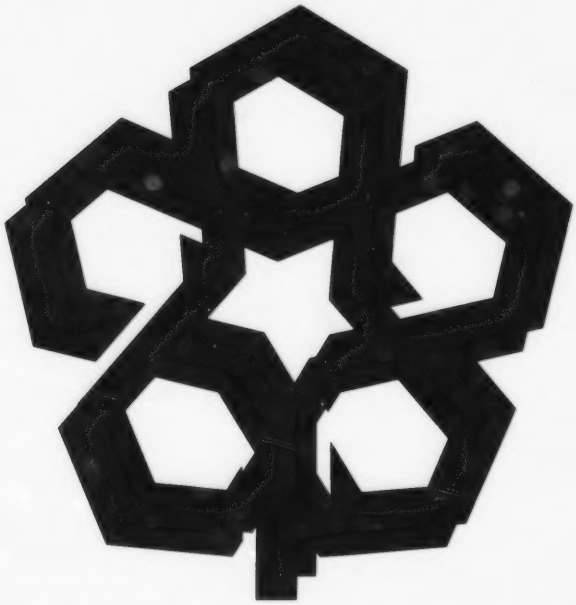
NETWORKS OF CENTRES OF EXCELLENCE



REPORT OF THE INTERNATIONAL PEER REVIEW COMMITTEE

AND

REPORT OF THE MINISTER'S ADVISORY COMMITTEE

INNOVACTION
The Canadian Strategy for Science and Technology

Government of Canada / Gouvernement du Canada

Natural Sciences and Engineering Research Council of Canada

Medical Research Council of Canada

Social Sciences and Humanities Research Council of Canada

Industry, Science and Technology Canada

EXECUTIVE SUMMARY

The three federal Granting Councils - NSERC, SSHRC, and MRC - were charged with organizing the process of inviting and reviewing applications to the Networks of Centres of Excellence Program, and making recommendations to the government on which proposals should be selected for funding. The Councils convened the 23 member International Peer Review Committee (IPRC), chaired by Dr. Stuart Smith, former head of the Science Council of Canada, to evaluate the 158 proposals that were received. The attached report includes the biographies of the IPRC members.

The IPRC considered 4 basic criteria:

- the excellence of the science and people involved (50%);
- the proposed linkages between university, industry, and government researchers (20%);
- the relevance of the research program to industrial competitiveness (20%); and
- the management structure (10%).

The IPRC used the recognized standards and procedures of peer review, relying on the reports of independent evaluators and site visits, where appropriate, as well as on their own collective, multi-disciplinary expertise. In the course of their three meetings in Ottawa, the IPRC unanimously recommended two categories of proposals for support: a group of nine "must be funded" proposals and a group of seven "recommended for funding" proposals. The assessments of the sixteen cases recommended by the IPRC are included in the report.

In turn, the report and recommendations of the IPRC were examined by the Advisory Committee to the Minister of State (Science and Technology), composed of thirteen Canadian business people and academics. The Committee was co-chaired by Dr. John Evans, Allelix Inc., and Dr. Gilles Cloutier, Rector, University of Montreal. The members' biographies are in the attached report.

The Advisory Committee closely monitored the IPRC selection process, attesting to its thoroughness and integrity. The Committee confirmed that the sixteen proposals recommended by the IPRC were indeed the most worthy of funding and selected twelve proposals for priority consideration. The Advisory Committee also recommended the creation of a team of experts to develop the research agreements and the funding arrangements appropriate to each network, as well as the continuation of joint Granting Council program management during the ensuing stages.

Minister of State
Science and Technology

Ministre d'État
Sciences et Technologie

In January 1988, the Right Honourable Brian Mulroney, Prime Minister of Canada, announced the $240 million Networks of Centres of Excellence Program, as a new initiative under InnovAction, the federal science and technology strategy.

The Government asked the three federal Granting Councils - the Social Sciences and Humanities Research Council, the Natural Sciences and Engineering Research Council, and the Medical Research Council - to conduct a competitive, peer review process involving international experts. The applications were to be judged against the highest standards of scientific excellence and on their plans regarding networking, industrial relevance and management. The Government committed itself to publish the report of this committee.

The Granting Councils developed the Program's selection criteria, invited proposals from the Canadian university and business communities, and convened the International Peer Review Committee (IPRC), chaired by Dr. Stuart Smith, former head of the Science Council of Canada. The 23 Canadian and foreign members of the IPRC were chosen for their research and industrial expertise. They studied each of the proposals in detail, referring to reports by external examiners and on-site reviewers where appropriate. The full IPRC report is provided as Appendix A.

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Ottawa, Canada K1A 0H5

The IPRC's activities were reviewed by my Advisory Committee made up of 13 eminent Canadians, co-chaired by Dr. John Evans, Chairman and Chief Executive Officer, Allelix Inc., and Gilles Cloutier, Recteur, Université de Montréal. The Advisory Committee confirmed the integrity of the selection process and the IPRC's recommendations on funding. The Advisory Committee report is attached as Appendix B.

The Government of Canada is indebted to all those who have participated in and supported the work of these Committees.

William C. Winegard

Attachments

APPENDIX A

NETWORKS OF CENTRES OF EXCELLENCE

INTERNATIONAL PEER REVIEW COMMITTEE

REPORT OF THE CHAIRMAN

June 16, 1989

The Honourable William Winegard, P.C., M.P.
Minister of State (Science and Technology)
235 Queen Street
8th Floor West
Ottawa, Ontario
K1A 1A1

Dear Dr. Winegard:

On behalf of the Tri-Council Steering Committee for the Networks of Centres of Excellence Program, composed of the Presidents of the three granting councils, I am pleased to transmit the report received today from the Chairman of the International Peer Review Committee for the NCE competition, Dr. Stuart Smith.

As you are aware, the granting councils were charged with the responsibility for selecting the membership of the International Peer Review Committee and for administering the process which resulted in the present report. The Presidents of the granting councils are of the opinion that the peer review process was fairly administered in the context of the published program criteria, and are supportive of the conclusions reached by the International Peer Review Committee.

Sincerely yours,

A.W. May

c.c.: Hon. Harvie Andre
P. Bois
P. Leduc
S. Smith
H. Rogers
R. Gualtieri

NETWORKS OF CENTRES OF EXCELLENCE
INTERNATIONAL PEER REVIEW COMMITTEE

REPORT OF THE CHAIRMAN

INTRODUCTION

The International Peer Review Committee (IPRC) for the Networks of Centres of Excellence (NCE) Program was appointed by a Tri-Council Steering Committee comprised of the Presidents of the three Granting Councils. The mandate of the IPRC was to review the 158 proposals submitted in the NCE competition on the basis of the published selection criteria and to make recommendations to the Tri-Council Steering Committee for transmittal to the Minister of State (Science and Technology) within the timeframe suggested by the Advisory Committee to the Minister.

The membership of the Committee was based primarily on the expertise and stature required to carry out the scientific evaluation of the research proposals received in the competition. In addition, expertise in industrial applications and research management as well as a balanced representation was given importance. The research community at large was consulted and assisted in the selection of the Committee.

Ten of the members of the Committee were from outside of Canada in order to conduct the evaluation by international standards. The international membership of the Committee also protected the process from the potential conflicts of interest arising from the very high participation of Canadian researchers in the competition. In addition the Committee was given conflict of interest guidelines and these were applied throughout the review process.

The membership of the IPRC is provided in appendix 1.

PROCESS

The International Peer Review Committee met 3 times and reviewed and discussed each of the 158 proposals. Each proposal was assigned to two members of the Committee for in depth review and all members participated in the evaluation and ranking of the proposals.

At the first meeting the Committee was briefed on the Program objectives and selection criteria. The proposals were screened by the Committee and recommendations were made regarding the information which would be required by the Committee to carry out its review.

Fifty-one proposals were reviewed by the International Peer Review Committee without further reference to external sources and a recommendation made by the Committee on the basis of that review. The Committee felt confident about these recommendations since the proposals were either clearly weaker than competing submissions or outside the terms of reference of the program.

The recommendations on a further fifty-eight proposals are made on the basis of review by the IPRC with the assistance of written evaluations. These external evaluations were carried out by experts in the particular field of research, chosen with advice from the Committee reviewers. In each case the evaluations were reviewed by the IPRC with the option to request review by an ad hoc committee if the excellence of the proposal called for such action.

Ad hoc committee review was carried out on the recommendation of the IPRC, either on the basis of its own review of the proposal or on the basis of strong written evaluations from expert reviewers. Forty-nine proposals were reviewed by ad hoc committees which submitted written reports to the IPRC.

In order to ensure a consistent approach, ad hoc committees were provided with written guidelines and each was accompanied by a program officer. In addition, project managers of the Industrial Research Assistance Program (IRAP) served as advisors to the ad hoc review committees to further encourage consistency of approach and to provide guidance on the Canadian industrial sector. Since ad hoc review was carried out only on the strongest submissions, the reports tended to be very supportive and required the careful discrimination of the experienced peers on the Committee to judge them in the context of competing submissions.

At the 2nd and 3rd meetings of the Committee all proposals were classified by the IPRC in one of the following categories:

must be funded;
recommended for funding;
not recommended for funding by this program.

At the final meeting of the Committee all proposals which had been placed in the first two categories were again reviewed in relation to the selection criteria. The category of each was confirmed or adjusted to ensure consistency and a decision was made to retain only the strongest proposals in the second category.

CONCLUSIONS AND RECOMMENDATIONS

The International Peer Review Committee had little difficulty in achieving unanimity and assures the Minister of the extremely high standard of excellence of the networks recommended for funding.

The members of the International Peer Review Committee unanimously recommend that the following nine networks **must** be funded by the Networks of Centres of Excellence Program. They are not ranked and are listed in order of the reception of the letter of intent by the Program Directorate.

Bacterial Diseases: Molecular Strategies for the Study and Control of Bacterial Pathogens of Humans, Animals, Fish and Plants

- University of British Columbia
- University of Alberta
- University of Calgary
- University of Guelph
- Université Laval
- University of Victoria
- National Research Council Canada*
- VIDO, Saskatoon
- Chembiomed
- Connaught Labs
- International Broodstock Technologies
- Microtek R&D Limited

Science and Engineering for High-Value Papers from Mechanical Wood-Pulps

- Pulp and Paper Research Institute of Canada
- Lakehead University
- McGill University
- McMaster University
- Mount Allison University
- Queen's University
- University of British Columbia
- University of Ottawa
- Université du Québec à Trois-Rivières
- University of Toronto
- University of Western Ontario
- National Research Council Canada*

Institute for Telecommunications Research
- McGill University
- Carleton University
- Concordia University
- INRS-Télécommunications
- McMaster University
- Queen's University
- University of British Columbia
- Université Laval
- Université de Montréal
- University of Ottawa
- University of Toronto
- University of Victoria
- University of Waterloo
- Alberta Telecommunications Research Centre

Neural Regeneration and Functional Recovery
- McGill University
- Université de Montréal
- Carleton University*
- Concordia University
- Dalhousie University
- McMaster University*
- Queen's University
- University of Alberta
- University of British Columbia
- University of Calgary
- Université Laval
- University of Lethbridge*
- University of Manitoba
- University of Ottawa
- University of Saskatchewan
- University of Toronto
- Biotechnology Research Institute*
- Ludwig Institute*

Centre of Excellence for Molecular and Interfacial Dynamics
- University of Waterloo
- Carleton University
- Dalhousie University
- McMaster University
- Queen's University
- University of British Columbia
- University of Guelph
- Université Laval
- Université de Montréal
- University of New Brunswick
- University of Saskatchewan
- Université de Sherbrooke
- University of Toronto
- University of Western Ontario
- National Research Council Canada*

Institute for Robotics and Intelligent Systems (IRIS)

- Precarn Associates Inc.
- Concordia University
- École Polytechnique
- INRS - Télécommunications
- McGill University
- McMaster University
- Queen's University
- Simon Fraser University
- Technical University of Nova Scotia
- University of Alberta
- University of British Columbia
- University of Guelph
- Université Laval
- Université de Montréal
- University of Saskatchewan
- University of Toronto
- University of Victoria
- University of Waterloo
- University of Western Ontario
- York University

Genetic Basis of Human Disease: Innovations for Health Care

- University of British Columbia
- Queen's University
- McGill University
- University of Calgary
- Université Laval
- University of Manitoba
- Université de Montréal
- University of Ottawa
- Université du Québec
- University of Toronto
- Biomedical Research Centre
- Institute de recherches cliniques de Montréal

Biotechnology for Insect Pest Management

- Queen's University
- University of Calgary
- University of British Columbia
- Université Laval
- University of New Brunswick
- University of Ottawa
- University of Toronto
- University of Waterloo
- University of Western Ontario
- York University
- Agriculture Canada*
- Forest Pest Management Institute*
- National Research Council of Canada*

* not in direct receipt of NCE funds

Protein Engineering: 3D Structure, Function and Design

University of British Columbia
University of Alberta
University of Toronto
Biomedical Research Centre
National Research Council of Canada - BRI*

The total 4-year funding requested by these networks is $189M.

Appendix 2 contains the evaluation reports of the IPRC on each of these proposals.

In addition, the International Peer Review Committee recommends the seven networks listed below for funding by the NCE Program. All are of very high quality and any could be supported with confidence. They are listed in the order received by the Program Directorate and the Committee has not expressed any priority amongst them.

Canadian Network for Research on High Temperature Superconductivity

McMaster University
Brock University
Queen's University
Simon Fraser University
University of Alberta
University of British Columbia
Université de Sherbrooke
University of Toronto
University of Waterloo
AECL Chalk River*
CTF Systems Inc.
Hydro Québec
National Research Council of Canada*
Ontario Hydro

Microelectronic Devices, Circuits and Systems for Ultra Large Scale Integration(ULSI)

University of Toronto
Carleton University
INRS-Énergie
McGill University
University of Calgary
University of Manitoba
University of Victoria
University of Waterloo
University of Windsor

Respiratory Health Network of Centres of Excellence

McGill University
McMaster University
University of British Columbia
University of Calgary

Université Laval
University of Manitoba
Université de Montréal
University of Saskatchewan
Employment and Immigration Canada*
Engineering Interface
Graham and Bierman
Merck Frosst*
Trudeau Medical

Ocean Production Enhancement Network
Dalhousie University
McGill University
Memorial University
University of British Columbia
Université Laval
Department of Fisheries and Oceans*

Canadian Network for Space Research
University of Calgary
University of Alberta
University of Saskatchewan
University of Western Ontario
York University
Atmospheric Environment Service*
Canadian Astronautics Limited
Com Dev Limited
Hertzberg Institute of
Astrophysics*
Institute for Space and Terrestrial
Science
Itres Research
Myrias Corporation
SED
SCI TEC*
Scientific Instruments Limited

Bétons à haute performance
Université de Sherbrooke
University of Alberta
McGill University
University of British Columbia
Université Laval
Université d'Ottawa
University of Toronto
Bickley and Associates
Hardy B.B.T.

Promoting Independence and Productivity in an
Aging Society
University of Toronto
Concordia University*
McMaster University*
Trent University*
University of Alberta*
University of Guelph
University of Manitoba

Université de Montréal*
University of Victoria*
University of Waterloo*
Aging and Rehabilitation Product Development Centre*
Corporate Health Consultants*

The total 4-year funding requested by these networks is $121M.

Appendix 3 contains the evaluation reports of the IPRC on each of these proposals.

The total funding requested by the networks which are recommended for funding is in excess of the available Program budget. However, the Committee expressed the hope that all would be supported, given the very high standards of selection and the exceptional quality of those recommended.

The International Peer Review Committee does not recommend the support of the remaining 142 proposals in the context of the Networks of Centres of Excellence Program.

Nevertheless the Committee points out that many of the proposals not recommended for funding are very meritorious; they simply cannot be recommended for support in the context of this program and this competition. In the opinion of the Committee, many of the excellent initiatives stimulated by the competition will continue and the linkages established should lead to funding from other sources.

Stuart Smith
Chairman
International Peer Review Committee

APPENDIX 1
Networks of Centres of Excellence

Chairman — S.L. Smith, President, Rockcliffe Research & Technology Inc. Ottawa, Ontario

Members

J.B. Bassingthwaighte, Professor of Bioengineering and Director of the Center for Bioengineering, University of Washington, Seattle, Washington

R. Blinc, Professor, Department of Physics, University of Ljubljana, Institut Jozef Stephan, Ljubljana, Yugoslavia

M. Bliss, Professor, Department of History, University of Toronto, Toronto, Ontario

M. Callon, Directeur, Centre de Sociologie de l'Innovation, École Nationale Supérieure des Mines, Paris, France

S. Carrière, Chef de la Direction, Associés de recherche médicale canadienne Inc., Montréal (Québec)

K.G. Davey, Vice President (Academic Affairs) York University, Downsview, Ontario

A. Davies, Professor, Department of Chemistry, University College London, London, England

D.I. Dunstan, Project Leader, Plant Biotechnology Institute, National Research Council of Canada, Saskatoon, Saskatchewan

J. Graham, Professor, Department of Economics, Dalhousie University, Halifax, Nova Scotia

G. Hetenyi, Scientific Advisor to the President, Medical Research Council of Canada, Ottawa, Ontario

J. Hoffmann, Professeur, Endocrinologie et Immunologie des Insectes, Centre national de recherches scientifiques, Strasbourg, France

R. Hood, Vice-President, Planning and Development, UMA Engineering Limited, Winnipeg, Manitoba

F. Jachimowicz, Manager, Organic Chemistry Research, W.R. Grace & Company, Columbia, Maryland

K. Lederis, Professor, Department of Pharmacology and Therapeutics, University of Calgary, Calgary, Alberta

J.D. Litster, Director of the National Magnet Laboratories, Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts

M.R. L'Archevêque, Vice-président, Recherche et technologie, Le Group SNC, Montréal (Québec)

A.B. Metzner Professor, Department of Chemical Engineering, University of Delaware, Newark, Delaware

B. Milner, Professor, Department of Neurology, Montreal Neurological Institute and Hospital, Montreal, Quebec

B.B. Parrish, General Secretary, International Council for the Exploration of the Sea, Copenhagen, Denmark

R. Price, Professor, Department of Geological Sciences, Queen's University, Kingston, Ontario

B. Schroeder-Gudehus, Professeur titulaire, Département de science politique, Université de Montréal, Montréal (Québec)

P.M. Will, Director, Measurement and Manufacturing Centre, Hewlett Packard Laboratories, Palo Alto, California

April 6, 1989

ANNEX 1

Chairman

Stuart Smith is the founder and President of Rockcliffe Research and Technology Inc.

Dr. Smith graduated in Medicine from McGill University. He was one of the original faculty members and a full-time Professor in the Department of Psychiatry at McMaster University's Medical School. His research there included work on hormones and behaviour and on the use of nurses as therapists in psychiatry. In 1975, Dr. Smith was elected to the Ontario Provincial Legislature where he became Leader of the Opposition in 1977. In 1982, he assumed the Chairmanship of the Science Council of Canada. After leaving the Science Council, Dr. Smith founded Rockcliffe Research and Technology Inc. He has been honoured for his public service by awards from the Canadian Advanced Technology Association, Conestoga College, Ryerson Polytechnic Institute, and the Government of France.

Members

James Bassingthwaighte is Professor of Bioengineering, Radiology, and Mathematics at the University of Washington in Seattle. He holds appointments in both the College of Engineering and the School of Medicine, and served as Director of the Center for Bioengineering.

Dr. Bassingthwaighte was born in Toronto and earned a B.A. and M.D. from the University of Toronto, where he also interned. He received a Ph.D. in Physiology from the University of Minnesota in 1964, and served on the faculty of the Mayo Medical School in Rochester, Minnesota, until moving to the University of Washington in 1975. Dr. Bassingthwaighte has served as Chairman of the Biotechnology Resources Advisory and Review Committee of the National Institutes of Health of the U.S.A., and as President of the Biomedical Engineering Society and of the Microcirculatory Society.

Dr. Bassingthwaighte's research interests are in biomedical engineering and cardiovascular and transport physiology.

Robert Blinc is Head of the Condensed Matter Laboratory of the Josef Stefan Institute, and Professor of Physics at the University of Ljubljana in Yugoslavia. He is also an Adjunct Professor at the University of Utah, Salt Lake City, Utah, and the University of Vienna, Austria.

Professor Blinc has over 300 journal publications, a number of major review articles and a monograph to his credit. He has won a number of prizes and holds a variety of positions in learned societies, including President of the European Council on Ferroelectricity; President of the Société AMPERE; member of the Slovenian, Yugoslav, Greek and Polish Academies of Sciences; member of advisory boards of a number of international journals.

Professor Blinc's research interests include the physics of disordered systems, the study of ferroelectrics, liquid crystals, and the application of nuclear magnetic resonance to condensed matter.

Michael Bliss is a Professor of History at the University of Toronto.

Professor Bliss has authored two books on the history of Canadian business, two biographies, and a history of the discovery of insulin. In addition, he has edited history texts and written over thirty scholarly articles, a variety of book reviews, and a large number of articles in publications such as Saturday Night, Maclean's, The Financial Post, and The Globe and Mail.

Professor Bliss has won a number of national and international prizes for his work, and is a Fellow of the Royal Society of Canada. He has served, or is serving, on various editorial boards and advisory committees. His current project is a history of the smallpox epidemic in Montréal in 1885.

Michel Callon is currently a Professor of Sociology at the Ecole nationale supérieure des mines, Paris. He is also Director of the "Centre de sociologie de l'innovation."

Dr. Callon has completed a Ph.D. in economics. He also holds a degree in engineering from the Ecole nationale supérieure des mines, Paris. Dr. Callon has authored a number of works in the following fields: socio-economy of innovation, public policies in research and technology (management, impact), and quantitative methods of analysis of scientific and technical dynamics.
Dr. Callon is a member of numerous scientific committees of French public research organizations and has held various teaching positions at the Ecole des mines and the Ecole centrale.

Serge Carrière is Professor and Director of the Department of Medecine at the Université de Montréal.

Dr. Carrière was awarded his M.D. degree from the Université de Montréal in 1959, served as a resident in internal medicine at Notre-Dame Hospital (1959-62) and was a Research Fellow in the Physiology Department of the Harvard Medical School (1962-64). He is certified as an internist by the Royal College of Physicians and Surgeons of Canada and the Collège des médecins et chirurgiens de la province de Québec, and as a nephrologist by the latter college. He has over eighty publications to his credit. Dr. Carrière has received several awards, including the Annual Scientific Prize from the Canadian Kidney Foundation (1983) and the Queen's Jubilee Medal (1977). He has served as Chairman of the Department of Physiology at the Université de Montréal. He is currently a member of numerous medical and scientific associations, and has served in senior positions in these and other scientific organizations.

Dr. Carrière's research interests are in the study of the cardiovascular system, the kidneys, and the autonomous nervous system.

Ken Davey is Distinguished Research Professor of Biology and Vice President (Academic Affairs) of York University in North York, Ontario.

Professor Davey earned bachelor's and master's degrees in Zoology from the University of Western Ontario and a Ph.D. in Insect Physiology from Cambridge University. He now has over 150 publications to his credit. His research has won him numerous honours and awards, including a Queen's Silver Jubilee Medal, Gold Medals from the Entomological Society of Canada and the Biological Council of Canada, and the Fry Medal from the Canadian Society of Zoologists. He is also a Fellow of the Royal Society of Canada and of the Entomological Society of Canada.

Professor Davey's research interests lie in the study of the physiology of insect reproduction, the biology of tsetse flies, invertebrate neuroendocrinology, and endocrine physiology of parasitic nematodes.

Alwyn Davies is Professor of Chemistry at University College London in London England.

Professor Davies completed his Ph.D. studies under Sir Christopher Ingold in London. He was granted a D.Sc. in 1959 and was made a Fellow of the Royal Society in 1989. He has published numerous articles in physical organic chemistry for which he was awarded The Royal Society of

Chemistry Medal and Prize in Organic Reaction Mechanisms. Professor Davies holds, or has held, a variety of appointments on councils and committees. He is an editor of the Journal of Organometallic Chemistry.

Professor Davies' research is in physical organic chemistry with particular emphasis on organic free radicals, main-group organo-metallic compounds, and organic peroxides.

David Dunstan is a Senior Research Officer and Project Leader of the Conifer Biotechnology Group of the National Research Council's Plant Biotechnology Institute in Saskatoon.

Dr. Dunstan received his Ph.D. in 1978 from North East London Polytechnic. After serving as a Research Fellow there, he came to Canada to establish a plant tissue culture laboratory at a nursery in B.C. In 1984, he became Vice-President, Research and Development, of AgriForest Technologies Ltd. Dr. Dunstan joined the National Research Council's Plant Biotechnology Institute in 1985. He has a number of publications and a patent related to plant tissue culture.

Dr. Dunstan's research interests are in conifer biotechnology: specifically, micropropagation of seed, seedling, adolescent and adult trees.

John F. Graham is currently Professor of Economics at Dalhousie University.

Dr. Graham received his Ph.D. from Columbia University. He was Head of the Dalhousie University Economics Department (1960-69) and was Skelton-Clark Visiting Research Fellow at Queen's University (1963-64). In addition, he was Visiting Professor at the Institute of Advanced Studies in Vienna in 1964. Dr Graham has been extensively involved in numerous government commissions and organizations such as the New Brunswick Royal Commission on Finance and Municipal Taxation, the Canada Council, the Newfoundland Royal Commission on Education and Youth, the Council of Ministers of Education, the Nova Scotia Royal Commission on Education, Public Services and Provincial-Municipal Relations (for which he was Chairman), the British Columbia Commission of Inquiry on Property Assessment and Taxation, and the Economic Advisory Panel of the Federal Minister of Finance. He has also held appointments with several non-governmental organizations. He has written many articles and books on intergovernmental fiscal relations, public finance, regional development and policy, university finance, and Canadian public policy, which are his areas of research interest.

Dr. Graham is a Fellow of the Royal Society of Canada, a Past President of the Academy of Humanities and Social Sciences of the Royal Society, and a Past President of the Canadian Economics Association.

Geza Hetenyi is Scientific Advisor to the President of the Medical Research Council, on leave from the Department of Physiology of the University of Ottawa.

Professor Hetenyi was born in Budapest, Hungary, where he received his medical doctorate. He completed a Ph.D. in Physiology at the University of Toronto and joined the faculty in the Department, rising to the rank of full Professor. In 1970, he moved to the University of Ottawa to chair the Department of Physiology until 1979. He then served as Vice-Dean of Health Sciences. In 1987 he assumed his current position. Dr. Hetenyi has over 120 publications in refereed journals and has received awards for his work. He has served on numerous committees and boards and as a reviewer for a wide variety of agencies and publications. He became a Fellow of the Royal College of Physicians and Surgeons in 1987.
Dr. Hetenyi's research interests are in endocrinology and the study of metabolic diseases, especially diabetes.

Jules Hoffmann is Director of the Laboratory of General Biology of the University of Strasbourg and of the CNRS Research Unit "Endocrinology and Immunity of Insects" in Strasbourg.

Dr. Hoffmann received his Ph.D. from Strasbourg University in 1969. After a postdoctoral stay in Marburg, Germany, he joined the faculty at Strasbourg and in 1988 assumed his current position.

Since 1983, he has chaired the CNRS Committee on Developmental Biology and Biology of Organisms in Paris.

Dr. Hoffmann's research interests are mainly in the biochemistry and molecular biology of hormones in relation to development.

Russ Hood is Vice-President, Planning and Development, of the UMA Group in Winnipeg.

Mr. Hood received degrees in civil engineering in 1953 and 1957. In 1958, he joined UMA, becoming a Vice-President in 1987. He has been responsible for a number of major engineering projects in railways, roadways, bridges, water supply, building design, and system studies. Mr. Hood has served in senior positions in

government and professional bodies. This service includes Commissioner, National Capital Commission; Past President, Canadian Council of Professional Engineers; Past Member, NRC Technology Centre; Past President, Engineering Institute of Canada.

Russ Hood is a practising engineer who is responsible for long-range planning, and development of UMA Group services.

Felek Jachimowicz is Manager of Organic Chemistry Research at W.R. Grace & Company in Columbia, Maryland.

Dr. Jachimowicz was born in Poland. He received his doctorate in Physical Organic Chemistry from the University of Basil in Switzerland in 1975. He served as a Senior Scientist at the State University of New York College of Environmental Science and Forestry, Syracuse, New York (1975-77), and moved to W.R. Grace & Company in Columbia, Maryland in 1978 as a Senior Scientist in the Research Division (homogeneous catalysis, polymer chemistry) until 1985, when he assumed his current position.

Dr. Jachimowicz's research interests are in physical organic chemistry, synthetic organic chemistry, electrochemistry, polymer chemistry, and colloids. He has authored many scientific papers and holds a number of patents.

Réal L'Archevêque is Vice-President, Research and Technology, of Le groupe SNC.

Dr. L'Archevêque holds a bachelor's degree in Electrical Engineering from the Ecole Polytechnique and a doctorate from the Imperial College of Science and Technology of the University of London, England. Following 13 years in research at the Chalk River Nuclear Laboratories of Atomic Energy of Canada Ltd., Dr. L'Archevêque joined Canatom in 1977 and became its President in 1981. In 1983, he moved to SNC. In addition to his SNC duties, Dr. L'Archevêque serves on a number of Boards of Directors and scientific committees.

Dr. L'Archevêque has expertise in electrical engineering and electronics, especially applied to instrumentation and real-time systems. He also has interests in industrial processes, waste management and environmental processes as well as biomass processing.

Karl Lederis is Professor of Pharmacology of the University of Calgary.

Professor Lederis studied medicine in Germany, then completed B.Sc., Ph.D., and D.Sc. degrees at the University of Bristol in the U.K. He was a Lecturer then a Reader in Bristol until he joined the faculty of the University of Calgary in 1969 as Professor of Pharmacology. Professor Lederis has over 230 publications, excluding abstracts, in scientific journals, and is an editor of 5 books. He has been a Visiting Professor or Scientist in France, Switzerland, Germany, Austria, the U.S., Ceylon, Peru, Chile, Argentina, Lithuania, Japan, the U.K. and the U.S.S.R.. He holds a number of appointments, including member of the Medical Research Council; Editor-in-Chief, Pharmacology; Fellow of the Royal Society of Canada.

Professor Lederis' research interests include the study of storage mechanisms, and the secretion and chemistry, structure, pharmacology, and gene expression of peptide neurohormones.

David Litster is Director of the Francis Bitter National Magnet Laboratory at the Massachusetts Institute of Technology.

Dr. Litster was born in Toronto and received a Bachelor in Engineering Physics from McMaster University. He received a Ph.D. in Physics from M.I.T. and joined the faculty there. Concurrently, Dr. Litster lectured in Physics at the Harvard Medical School for eleven years. He became Head of the Division of Atomic, Condensed Matter, and Plasma Physics in the Physics Department at M.I.T. in 1979, then became the Director of the M.I.T. Center for Materials Science and Engineering in 1983. He assumed his current position in 1988. Dr. Litster serves as a regional editor for Molecular Crystals and Liquid Crystals and as a member of the Solid State Sciences Panel of the National Research Council (U.S.A.). He is on the Advisory Board of the Canadian Institute for Advanced Research.

Dr. Litster's research interest is in solid state physics, including x-ray and light scattering, statistical mechanics, and the study of complex fluids.

Arthur B. Metzner is H. Fletcher Brown Professor at the University of Delaware.

Dr. Metzner is a University of Alberta graduate and was awarded a Sc.D. in Chemical Engineering at M.I.T. in 1951. He is the recipient of numerous distinguished scientific awards, including most of those provided by the American Institute of Chemical Engineers for excellence in research, and the Bingham Medal of the Society of Rheology. In addition, he was elected to the National Academy of Engineering (1981), and has held several distinguished lectureships and received a D.Sc. honoris causa from the Catholic University of Louvain, Belgium.

Dr. Metzner's research areas have involved polymer processing, fluid mechanics, and the processing of polymeric high strength composites.

Brenda Milner is Professor of Psychology in the Department of Neurology and Neurosurgery at McGill University. She is also Director of the Neuropsychology Laboratory at the Montreal Neurological Institute and Hospital, and a Career Investigator of the Medical Research Council of Canada.

Dr. Milner received a Ph.D. from McGill University and a Sc.D. from the University of Cambridge. She also holds several honorary degrees and has received many distinguished scientific awards and prizes, including Kathleen Stott Prize for Medical & Scientific Research from Newnham College, Cambridge; Izaak Walton Killam Memorial Prize, awarded by the Canada Council; Officer of the Order of Canada; "Femme de l'année 1985," Quebec, in Science. Dr. Milner has held appointments as Professor of Psychology at the Université de Montréal and as a Research Associate in the Psychology Department at McGill University. She is a Fellow of the Royal Societies of London and of Canada and is a Foreign Associate of the National Academy of Sciences of the U.S.A. She is also a member of various scientific organizations and has authored numerous research publications in the fields of Psychology and Neurology.

Basil Parrish was, until his retirement in April 1989, General Secretary of the International Council for the Exploration of the Sea in Copenhagen.

Dr. Parrish earned a 1st Class Honours B.Sc. degree from Reading University in 1943. He was awarded an Honorary D.Sc. degree by the University of Aberdeen in 1984.
Dr. Parrish assumed his last position in 1983, following his retirement as Director of Fisheries Research for the Scottish Department of Agriculture and Fisheries Marine

Laboratory in Aberdeen. He had previously served as a research scientist at the Laboratory from 1946, following wartime service in Operational Research with the RAF. Dr. Parrish's research was concerned with investigations of the biology, ecology, behaviour and population dynamics of exploited fish resources in the North East Atlantic, and the provision of scientific information and advice to government and international fishery regulating commissions on their conservation and management. Throughout his career, he was actively involved in the activities of the International Council for the Exploration of the Sea, and served as its President from 1976-79.

Dr. Parrish was awarded a Commander of the British Empire (CBE) award and is a Fellow of the Royal Society of Edinburgh and of the U.K. Institute of Biology.

Raymond A. Price is Professor of Geology at Queen's University.

Dr. Price received his Ph.D. in Geology from Princeton University in 1958. For ten years he was employed by the Geological Survey of Canada, whereupon he joined the faculty at Queen's University. From 1978-80 he was a Killam Research Fellow. In 1981, Dr. Price returned to the Geological Survey, where he eventually became Assistant Deputy Minister. He has recently resumed his academic career at Queen's. Dr. Price has received numerous prestigious national and international scientific awards and distinctions. He has held several distinguished lectureships and has a D.Sc. honoris causa from Carleton University. Dr. Price is a Fellow of the Royal Society of Canada, the Geological Society of America, a Foreign Associate of the U.S. National Academy of Sciences, an Honorary Foreign Fellow of the European Union of Geosciences and is a member of many scientific and professional societies. He has authored many publications in Geology.

Dr. Price's research interests are in structural geology, geotectonics, and crustal evolution. He also has interests in global change in the geosphere and biosphere, and in science and public policy.

Brigitte Schroeder-Gudehus is Professor of Political Science at the Université de Montréal.

Dr. Schroeder-Gudehus received a Ph.D. in International Relations from the University of Geneva. She has held teaching positions at the Université de Montréal and Johns Hopkins University and was seconded to the Science Council of Canada in 1971-72. She is a member of the International Council of Science Policy Studies and of

the International Commission for a Scientific and Cultural History of Mankind (UNESCO). She has authored several articles and books in the following fields: international scientific and technical relations, science and technology in foreign policy and political history of sciences. She is currently on leave of absence from the Université de Montréal to serve as Director of the Centre de recherche en histoire des sciences et des techniques at the Cité des sciences et de l'industrie, La Vilette (Paris).

Peter Will is Director of Hewlett-Packard's Measurement and Manufacturing Center in Palo Alto, California.

Dr. Will was born in Peterhead, Scotland, and received bachelor's and doctoral degrees in Electrical Engineering from the University of Aberdeen. From 1965 to 1980 he served in a variety of positions in automation and robotics for IBM Corp. Dr. Will then joined Schlumberger, where he managed artificial intelligence programs before becoming Director of VLSI Systems for Schlumberger's Fairchild Division. He joined Hewlett Packard in 1987.

Dr. Will holds, or has held, a number of appointments with committees of the
National Science Foundation and the National Academy of Sciences in the U.S.

APPENDIX 2

"Bacterial Diseases: Molecular Strategies for the Study and Control of Bacterial Pathogens of Humans, Animals, Fish and Plants" **Request: $21,738,407**

The network

This application is submitted by the University of British Columbia. A network of 45 participants from seven universities, 4 companies and the National Research Council are identified to work together to study bacterial pathogens in humans, animals, fish and plants.

Eleven specific projects are proposed with 33 research objectives identified. The research is focused on bacterial diseases and in particular on the cell surface structures and excreted protein aspects of bacterial disease.

The excellence of the science and of the people involved

A highly innovative and very focused research program. The participants include internationally known researchers who have contributed much of the literature in this field and who are recipients of many awards and professional honours. Some of the new technology to be used has been developed by the applicants.

Adequate provisions have been made for the development of highly qualified research personnel.

The linkages and networking

There are strong linkages with industry which build upon existing partnerships. There are participants named from four companies where financial support is requested. Direct financial contributions of approximately $1 million per year are pledged by three of the four companies requesting support. The network has the interest of a number of other companies and letters of support were provided.

Within the network, linkages are also very strong. Some of the participants have previously worked together and have authored joint publications. The complementarity of expertise included ensures the integration and cohesiveness of the research program.

The relevance to future industrial competitiveness

The network has placed emphasis on the involvement of small and medium sized Canadian companies rather than multinational companies. The long term potential for products lies in vaccines, antibiotics and diagnostic kits. Control of bacterial disease also has relevance for agriculture, fisheries and forestry.

The administrative and management capability

A management structure and mechanisms for decision making, accountability, and re-direction of resources and research orientation have been developed. This structure provides for strong leadership and should facilitate and encourage collaborative research and effective dissemination of information.

Recommendation

The International Peer Review Committee recommends that this application must be funded under the Networks of Centres of Excellence program.

"Science and Engineering for High-Value Papers from Mechanical Wood-Pulps"

Request: $15,372,300

The network

This proposal is submitted by PAPRICAN, the Pulp and Paper Research Institute of Canada, a private sector research consortium of Canadian pulp and paper companies. The proposal brings together a multi-disciplinary team of 27 scientists and engineers from 10 universities, NRC and PAPRICAN.

The focus of the research program is to solve fundamental problems related to the production of high brightness, high yield and high strength chemically treated mechanical pulps (CTMP). The program has two major components: the first is concerned with chromophore chemistry and the bleaching and refining steps of the pulping process; the second addresses issues related to adaptive control and processing.

The excellence of the science and of the people involved

All stages of the pulping process will be studied in a concerted manner. The program is leading edge research, comparing favourably with similar efforts elsewhere in the world, and several participants are internationally respected. A large portion of the budget (65%) is related to the development of highly qualified research personnel.

The linkages and networking

The network will use the existing structure of PAPRICAN for the dissemination of results and technology transfer. The Institute is contributing $8.0 million to the network by supporting the research of the three PAPRICAN participants and by a number of initiatives in the participating universities.

The relevance to future industrial competitiveness

Pulp and paper is one of the largest industries in Canada. The network's program is the result of a recent exercise to identify priorities for the industry. If successful, this research could greatly increase the yield from our forests. The characteristics of Canadian woods are especially well-suited for CTMP, and the low cost of hydroelectric power offers another advantage.

The administrative and management capability

PAPRICAN will be responsible for the overall management and scientific leadership of the network . The Institute has a 60 year history of research and networking. Each major aspect of the program will be guided by a project leader who will be responsible for coordinating efforts and fostering linkages and communications between the participants.

Recommendation

The International Peer Review Committee recommends that this application must be funded under the Networks of Centres of Excellence program.

"Institute for Telecommunications Research (ITR)" **Request: $15,464,000**

The Network

This proposal brings together 30 participants from 12 universities, one university-based research institute and one non-profit company. The research program includes two components: broadband and wireless communications. The broadband program focuses on three themes: broadband networks and services, optoelectronic devices and systems and communication software engineering. The wireless program also has three elements: mobile communications, microcellular networks and, source and channel coding.

The excellence of the science and of the people involved

The research program is well formulated, brings together diverse areas, and includes a mix of basic and applied research.

Selectivity has been exercised in putting together the team; many of the participants are outstanding researchers with international reputations. The program leader has a wide experience of the university-industry environment and of the management of targeted research.

The linkages and networking

The network will build on existing linkages. Researchers and industrial partners will work toward specific applications. The research program was designed with industrial participation and representatives from Canadian companies will serve on the Board of Directors. While the level of new industrial contributions to the network is low, it is expected that both cash and in-kind contributions will increase once the network begins to operate.

The relevance to future industrial competitiveness

Telecommunications are strategically important for Canada, a country which has a competitive advantage in this area. Some of the technologies are particularly relevant, given Canada's substantial rural population and large isolated areas. The projects described in the wireless program offer opportunities for applications in the short term.

The administrative and management capability

The management structure will facilitate collaborative research and the dissemination of results. There is a balance between users and performers on the Board of Directors and strong leadership at the level of each program component.

Recommendation

The International Peer Review Committee recommends that this application must be funded under the Networks of Centres of Excellence program.

"Neural Regeneration and Functional Recovery" **Request: $33,975,062**

The network

This application is jointly submitted by McGill University and the Université de Montréal. The network brings together over 100 participants (20 key investigators) from 14 universities to work on seventeen research themes in two general areas, Neurobiology and Functional Recovery. Five core facilities and a training program are also proposed.

The excellence of the science and of the people involved

The research projects proposed are highly innovative and well integrated into a cohesive program which is outstanding by international standards. The participants have proven track records and the program leaders are internationally recognized. Canada has an unusual concentration of expertise in this field of research and has made significant contributions. The proposed training program will support the training of an additional 20 Ph.D. students and 35 post doctoral fellows.

The linkages and networking

A number of the participants have existing contracts with a significant number of companies. Funding of the network should help secure additional contracts.

Linkages within the network are strong. The five core facilities will strengthen the integration of the collaborative research program proposed.

The relevance to future industrial competitiveness

Canada is acknowledged to be in a position of scientific leadership in the neurosciences. The economic benefits of the research are likely to be through reduction of disease, improved therapy and savings in health care costs. Because some contractual arrangements exist, the issue of how certain of the industrial benefits will accrue to Canada, should products result from the research, needs clarification. The international peer review committee feels such issues require negotiation should an award be made.

The administrative and management capability

A management structure is proposed which should facilitate collaborative research. Well delineated lines of authority have been identified.

Recommendation

The International Peer Review Committee recommends that this proposal must be funded under the Networks of Centres of Excellence program. At the same time, it stresses the need for negotiation of intellectual property rights.

"Centre of Excellence for Molecular and Interfacial Dynamics"

Request: $21,544,769

The network

This proposal is submitted by the University of Waterloo and involves 43 university participants and two from the National Research Council. Fourteen different universities are represented.

The general area of the research in the proposal is Chemical Physics. Within this area, the group proposes to focus on three aspects. They are: Spectroscopic Studies of Small Molecules and Clusters; Reaction Dynamics; and Dynamics at Surfaces and Interfaces.

The excellence of the science and of the people involved

Research in chemical physics has already led to two Nobel Prizes for Canadians (including one of the network participants) and this work has real potential for yet another. The science is outstanding by international standards. The applicants are well known and are led by a strong scientific leader. There will be excellent opportunities for the development of highly qualified research personnel.

The linkages and networking

Good communication between the network participants is expected and will facilitate collaborative research. There is no direct industrial participation in the network's research program but there is no Canadian industry doing basic research in chemical physics. In spite of this, the applicants have a history of working well with industry.

The relevance to future industrial competitiveness

The research proposed has a number of applications in major industries and the applicants have a history of spinning off usable technologies from their basic research. A notable development from research in this area is the chemical laser. Other areas where members of this group have made applied contributions include:

oxidation studies; ion implantation; defect profiling; catalysis; analytical systems; magnetic materials for high-density vertical memories; electrodes; fuel cells; and commercial spectrometers.

The administrative and management capability

The management structure proposed appears well suited to the network. The applicants highlighted mechanisms for providing for industrial input into the network's research directions and for technology transfer.

Recommendation

The International Peer Review Committee recommends that this proposal must be funded under the Networks of Centres of Excellence program.

"Institute for Robotics and Intelligent Systems (IRIS)" **Request: $31,703,000**

The network

This proposal is submitted by PRECARN (Pre-Competitive Applied Research Network), a not-for-profit private sector consortium of 32 companies with a mission to carry out and promote scientific research and development in advanced robotics and artificial intelligence technologies. The IRIS proposal comprises 22 projects under the general areas of computational perception, knowledge-based systems and intelligent robotic devices. The proposed research will be carried out by 56 investigators in 15 universities across Canada.

The excellence of the science and of the people involved

The IRIS research program integrates research into three areas that are inherently related but which have traditionally been studied separately: perception, reasoning and responsive action. While the scope of the program is broad, the projects focus on clearly identified areas of strength and have well conceived goals. Many aspects are at the frontier of knowledge in the field; others compare well with similar efforts world-wide.
The strongest Canadian researchers in these areas are included in this network. Many of the participants are well-known internationally. Particular strengths are in the area of perception, most notably in computer vision.

The linkages and networking

Linkages are strong between researchers in each of the three areas; an important role of the scientific leader will be to enhance interactions between researchers across the three areas.

IRIS will operate as a separate component of PRECARN but, through PRECARN's existing committee structure, it can benefit from the participation of industry in program review and knowledge dissemination. The commitment of PRECARN's staff and committee members to the IRIS network is estimated at over $268,000 per year.

The relevance to future industrial competitiveness

IRIS focuses on enabling technologies that have applications in a broad spectrum of industry. Industry interest is reflected in the membership of PRECARN which includes resource and energy sector companies, suppliers of artificial intelligence and robotics products, and communications and aerospace companies. Specific niches for Canada are already identified in the area of robotic devices for use in hazardous environments.

The administrative and management capability

The scientific leader and the administrative leader together form an effective team. Clear mechanisms for monitoring, audit and evaluation, planning and exploitation are in place.

Recommendation

The International Peer Review Committee recommends that this application must be funded under the Networks of Centres of Excellence program.

"Genetic Basis of Human Disease: Innovations for Health Care" **Request: $18,215,691**

The network

This network, centred at the University of British Columbia, brings together 22 participants and 17 major collaborators from 11 institutions. A research program consisting of seven major themes is proposed to investigate human genetic disease.

The excellence of the science and of the people involved

Canada has international strengths in the field of human genetics. The research objectives proposed are at the leading edge and the participants include some of the world leaders in the area. An innovative and cohesive research program proposes an integrated, interdisciplinary approach to identifying and analyzing the structure and function of genes that cause human disease by applying technological advances in conjunction with biological advances. Training of graduate students and post doctoral fellows is stressed in the application.

The linkages and networking

There are financial commitments from industry as well as access to personnel and resources. Exchange programs between industry and the core facilities and research centres are planned. Industry representatives will participate in the management structure proposed for the network.

The network includes outstanding Canadian university researchers in this area. The core facilities proposed will allow for efficient collaboration within the network.

The relevance to future industrial competitiveness

In addition to the potential for commercial exploitation in the areas of diagnostics and therapeutics, indirect benefits in terms of increased public health and reduced health care costs are anticipated. Genetic disease is a problem of international significance and an area where Canada has a tradition of excellence. In addition, unique genetic records are available for research.

The administrative and management capability

The revisions to the management structure presented to the ad hoc review committee were considered appropriate and a strong and effective structure is described. Leadership is apparent and mechanisms for decision making are proposed.

Recommendation

The International Peer Review Committee recommends that this application must be funded under the Networks of Centres of Excellence program.

"Biotechnology for Insect Pest Management" **Request: $9,157,778**

The network

The network proposal, centred at Queen's University, includes 25 participants from the universities of British Columbia, Calgary, Western Ontario, York, Toronto, Waterloo, Ottawa, Laval, and New Brunswick as well as the London (Ont) Research Institute of Agriculture Canada, the Forest Pest Management Institute of the Canadian Forestry Service and the Biotechnology Research Institute of the National Research Council.

The program is focused on developing new, environmentally acceptable methods of pest control. It will explore the use of biotechnology to alter naturally occurring viruses so as to render them more toxic and selective in their attack on insects; to use the hormonal systems of insects as control mechanisms; to minimize the development of resistance to conventional pesticides; and to exploit genetic mechanisms for insect control.

The excellence of the science and the people involved

The research program is innovative, well focused, integrated, and takes a long term applied perspective to fundamental questions.

The applicants are internationally known and a number are world leaders in this area. Insect physiology is considered to be an area of particular strength in Canada. The network leader is widely respected and will provide strong scientific leadership to the group.

The network provides an excellent opportunity for the training of future researchers in insect biology with expertise in molecular biology. These are currently in short supply.

The linkages and networking

There are strong linkages within the group based on past and current collaborative research. The reliance of the participants on the expertise and results of others within the network makes this a synergistic effort.

The industrial linkages and commitments are, as yet, not very large; this is not surprising in view of the industry's current commitment to chemical pesticides. Industry is expected to provide the network with advice on research directions and access to industry expertise and facilities. Industry will gain access to research results from a rapidly developing area. It is anticipated that the industry linkages will continue to grow as the network program evolves.

The relevance

Although the economic benefits may be long term, the demand for insect pest management strategies which are not deleterious to the environment is increasing. Pest control in agriculture and forestry is particularly important in Canada, as losses in these industries due to insect damage may range up to fifty percent.

The administrative and management capability

The network structure and management proposed will ensure effective collaboration as well as redirection of resources if required.

Recommendation

The International Peer Review Committee recommends that this application must be funded under the Networks of Centres of Excellence Program.

"Protein Engineering: 3D Structure, Function and Design" **Request: $22,320,000**

The network

This network, centred at the University of British Columbia, includes 21 participants from the universities of Toronto, Alberta and British Columbia as well as from the Vancouver Biomedical Research Centre, the Division of Biological Sciences and the Biotechnology Research Institute of the National Research Council.

The research program uses a variety of techniques aimed at understanding and then improving proteins. Studies will be directed at new peptide hormones; cell growth factors for the treatment of cancer and infectious diseases; new enzymes that can be used in the chemical industry, forestry or agriculture; as well as fundamental studies on protein design.

The excellence of the science and the people involved

The program is a world class initiative, is well integrated and builds on unique Canadian strength. The network brings together outstanding researchers including two who are international leaders in the field.

The network will be an excellent vehicle for graduate student and post-doctoral fellow training.

The linkages and networking

There is a history of collaborations within the group. Sharing of major facilities and interdependence among program aspects are features of the network.

Each of the major themes constitutes an area of interest to one or more of the companies linked to the network, and at least one of the companies is strongly involved at a scientific level. Although there are no cash contributions several of the companies have indicated contributions of resources and in-kind donations.

The relevance

The network has excellent potential for technology transfer and industrial spin-offs. Industrial initiatives laboratories will be established by the network and will be accessible to Canadian industry.

The approach adopted by the network is consistent with

the cooperative university/industry approach in other countries.

The administrative and management capability

Although the general management structure proposed is acceptable, improvements are required to ensure that an effective central management is in place.

Recommendation

The International Peer Review Committee recommends that this application must be funded under the Networks of Centres of Excellence program and suggests that steps be taken to ensure that an effective management structure is in place.

APPENDIX 3

"Canadian Network for Research in High Temperature Superconductivity" **Request: $19,508,030**

The network

This proposal is submitted by the Institute for Materials Research at McMaster University in Hamilton. It brings together 75 participants from nine universities, three companies, and the National Research Council.

The subject of this application is the new area of high critical temperature superconductors. That is, materials which offer zero electrical resistance at temperatures well above the -269°C (four degrees above absolute zero) at which conventional superconductors operate. The eight research areas proposed for study are: Theory of High Temperature Superconductivity (HT_cSC); Materials Development and Characterization; Neutron, X-Ray, and Electron Diffraction; Muon, Electron, and Nuclear Magnetic Resonance; Optical Properties of Thin Films; DC and Microwave Transport and Tunnelling; High-T_c Device Development; and Large Scale Electrical Applications.

The excellence of the science and of the people involved

The research program is original and promises significant advances in the field. The applicants are nationally and internationally respected for their consistent output of quality research. The program will provide excellent opportunities for the development of highly qualified research personnel who will be trained in not only HT_cSC but also general materials science which is useful to a variety of industries.

The linkages and networking

There are strong linkages with the three industrial participants in the proposal. Ontario Hydro and Hydro Québec are involved in the study of conventional (low temperature, or LT_cSC) superconducting devices for power storage and transmission. The other company involved, CTF Systems, is a Canadian manufacturer of Superconducting Quantum Interference Devices (SQUIDs) which are magnetic detectors which can be used in applications from remote sensing to medical imaging. The industrial partners have pledged support totalling $3,644,000 over four years.

The relevance to future industrial competitiveness

The research proposed has a variety of potential applications. High-T_c materials may eventually be used in superconducting computers and electronics; superconducting magnets that do not require expensive liquid helium cooling (eg. in SQUIDs); and high power applications such as power storage, low-loss transmission lines, and devices such as fault-limiters and switches. Applications, especially the high-power ones, may be fairly long-term prospects. However, the research proposed would make significant contributions to materials science in general regardless of the outcome of HT_cSC research.

The administrative and management capability

While the committee feels the group is learning from its experience with the Ontario Centre for Materials Research, it also feels the network management requires improvement. The network participants belong to disciplines traditionally used to working independently so special attention to ensuring the linking of the different theme areas will be required. To this end, the ad hoc committee reviewing this proposal recommended the group seek the advice of a professional management consultant.

Recommendation

The International Peer Review Committee recommends funding of this application under the Networks of Centres of Excellence Program.

"Microelectronic Devices, Circuits and Systems for Ultra-Large Scale Integration (ULSI)" **Request: $14,000,000**

The network

This proposal brings together twelve researchers from nine universities. Their research will focus on semiconductor technologies with minimum component dimensions in the one micrometer and submicrometer range. The proposal is supported by over a dozen Canadian companies which will actively participate in the program.

The excellence of the science and of the people involved

The proposal integrates Canadian microelectronics research by tying together efforts in devices, circuits and systems. The research proposed is at the leading edge of the field. The network will create a novel environment where participants and students working in one area will be exposed to the issues, constraints and advances in the other two.

The participants are internationally recognized researchers who are making a substantial commitment to the networking concept. The network is led by a strong scientific leader.

The linkages and networking

The research program will proceed in a strong industrial context. Industry has actively participated in defining the directions of the network's research. Considerable support in the form of personnel and access to expensive facilities will be provided.

The relevance to future industrial competitiveness

Microelectronics is a basic technology in many areas where Canada has a lead; it is therefore very important for the country to maintain a strong presence in the field. The network is a way of achieving critical mass to sustain research efforts, attract top people to Canada and encourage students to enter the field.

The administrative and management capability

An Advisory Board including high level industry executives will provide input on directions and targets. Clear mechanisms for research coordination and financial management have been described.

Recommendation

The International Peer Review Committee recommends funding of this application under the Networks of Centres of Excellence program.

"Respiratory Health Network of Centres of Excellence" **Request: $20,534,225**

The network

This proposal is submitted by McGill University and identifies sixty-two participants. Fifty four are university-based, seven are from the private sector and one is from Employment and Immigration Canada.

The research program is in the area of airway obstruction and inhalational lung disease; it consists of 12 research projects relating to 5 major themes.

The excellence of the science and of the people involved

The program is focused despite its magnitude and presents a comprehensive, diversified, multidisciplinary approach. Some projects are not outstanding but are improved by being within the network.

The leadership is of high quality and the participants include several who are known internationally.

The linkages and networking

Ten companies are involved in the network research program. Five of those companies are identified in the budget to receive funding. The participant list also includes an industrial designer. There are no new financial commitments to the network, although the researchers currently receive support which will be rolled into the network and some in-kind contributions are indicated.

There is communication and sharing of both data and analytical methods within the network. The investigators have previously worked together.

The relevance to future industrial competitiveness

A long term potential for products exists and good choices have been made in the areas selected. Users are participating in the program. In addition, the program may result in improved patient care and reduced health care costs.

The administrative and management capability

The network possesses the required experience to manage. Leadership is identified. The addition of an outside advisory body, as discussed at the visit, will strengthen the management structure.

Recommendation

The International Peer Review Committee recommends funding of this application under the Networks of Centres of Excellence program.

It also recommends that certain budgetary issues be examined to determine an appropriate level of funding. These include ineligible part time release for participants (almost $7 million), additional justification for the equipment requested and potential overlap of existing funding.

"Ocean Production Enhancement Network (OPEN)" **Request: $26,791,335**

The network

The network, which will be centred at Dalhousie University, includes participants from Memorial University, Dalhousie University, Université Laval, McGill University, the University of British Columbia and the Bedford Institute of Oceanography of the Federal Department of Fisheries and Oceans.

Fisheries biologists and oceanographers will investigate the processes which control survival, growth and reproduction of fish and shellfish in an integrated research program. New instrumentation will be developed for use in these studies.

The excellence of the science and the people involved

This program is well integrated, focused, and is ahead of similar international efforts proposed in this field. The interdisciplinary exploration of coastal physical oceanography, physiology and genetics as related to population ecology of marine organisms, is unique.

Most of the researchers, including a strong scientific leader, are excellent and some are recognized internationally.

The linkages and networking

There is a long tradition of past collaborations, especially for the participants from the Groupe Interuniversitaire de Recherche Océanographique du Québec(GIROQ).

As to industrial linkages, the network is supported by three of Canada's largest seafood companies which have been involved in the planning of the program from the beginning. Direct contributions from the industrial partners, as well as from the province of Nova Scotia, are considerable.

The relevance

The primary species in these studies are the Atlantic cod and sea scallops, chosen because of their economic value in Canadian fisheries and aquaculture. There will be indirect benefits from the cod studies as the results will be used by government in resource management.

The administrative and management capability

This network has a well defined, detailed management structure to ensure effective collaboration and program integration.

Recommendation

The International Peer Review Committee recommends funding of this application under the Networks of Centres of Excellence program.

"Canadian Network for Space Research" **Request: $27,300,187**

The network

The Network will be centred at the University of Calgary and involves 36 participants at six universities, two government facilities, and five companies.

The research proposed in this application is the study of processes and phenomena occurring in the middle atmosphere and above. There are seven tightly integrated projects, or themes, which make up this program. They are: Middle Atmospheres; Auroral Processes; Polar Environment; Plasma Environment in Space; Spacecraft Instrumentation; Space Astronomy; and 3-D Middle Atmosphere Modelling.

The excellence of the research and of the people involved

Canada has historic strength in space research and the proposal promises significant advances. The program builds on a unique combination of technical talent and Canada's geographic advantage due to its arctic location. The participants are responsible for Canada's strength in the field and are internationally respected. They form a cohesive group. The program will provide opportunities for the development of highly qualified research personnel for both the aerospace industry and universities.

The linkages and networking

There are strong linkages with the five industrial participants in the proposal. The companies are providing support of almost $1.7 million over four years. They were involved in the development of the research program and will participate in the proposed management structure.

Internally, the group is very cohesive and has a history of effective collaborative research. They also have a long history of spinning off technology. In fact, four of the five industrial partners in this network arose from Canadian space research.

The relevance to future industrial competitiveness

The fundamental research proposed has longer term applications in space system longevity (eg. communication satellites or the space station), communication and power transmission stability, and global change considerations such as global warming and stratospheric ozone depletion. The more applied aspects of the program are directed at advances in spacecraft instrumentation and remote sensing technology. The Canadian companies involved in these applied areas are the industrial participants in the proposal.

The administrative and management capability

At the ad hoc review committee meeting, the applicants elaborated a management structure that would facilitate the collaborative research proposed. The leadership is identified and mechanisms for accountability and re-direction of resources were described.

Recommendation

The International Peer Review Committee recommends funding of this application under the Networks of Centres of Excellence Program.

"Bétons à Haute Performance" **Request: $6,707,541**

The network

This proposal will integrate the research efforts of 11 materials experts, designers and practitioners from seven universities and two consulting firms. The proposed research on high performance concrete is grouped under three themes: the development of a new generation of construction materials, the construction and performance of structures, and the development of new products and techniques.

The excellence of the science and of the people involved

The research program is coherent and is at the leading edge in the field of high performance concrete. It should provide the knowledge necessary to engineer the material and tailor its properties to specific uses.

The participants have impressive records in terms of scientific papers, awards and participation on international committees. The leader is a dynamic and internationally respected researcher who is known to apply research results to real situations.

The linkages and networking

The researchers have a history of multi-disciplinary collaborations. The Canadian Portland Cement Association, Ciment St-Laurent, Lavalin, Hydro-Québec, the Ministère des Transports du Québec and others are supporting the application. They have had input into its development through long-standing relationships with the participants.

The relevance to future industrial competitiveness

Concrete is the most widely used material in construction; anticipated benefits of the research include more durable and corrosion resistant concrete for highways and bridges, and adequate testing methods for the safe use of high performance concrete in offshore platforms and tall buildings. Advanced knowledge of the properties of high performance concrete is important to the internationally successful Canadian consulting engineering firms.

The administrative and management capability

The management structure proposed by the network is simple and efficient. Industry and government representatives will be part of an Advisory Council identifying priorities and accelerating technology transfer.

Recommendation

The International Peer Review Committee recommends funding of this application under the Networks of Centres of Excellence program.

"Promoting Independence and Productivity in an Aging Society" **Request: $5,972,417**

The network

This network centred at the University of Toronto includes 24 researchers from 11 universities, and 2 industrial partners.

The goal of the network is to foster the independence of older Canadians and increase their productivity. There are three major thrusts in the research program: Project A will focus on the evaluation of specific products and services for the elderly and care givers of impaired elderly; Project B will examine the effects of care giver stress on occupational life and job performance; Project C will investigate environmental factors affecting independence and cognitive performance of older people either retired or in the work force.

The excellence of the science and the people involved

The applicants involved in the network are very productive and are recognized internationally for their contributions to the field of aging and to psychology. There is a strong scientific leader.

The proposal is well focused and cohesive although some aspects could have been more detailed. Its innovative feature is the integration of the 3 projects and the inclusion of a strong cognitive functioning component.

The linkages and networking

The linkages are strong and the participants have a history of collaboration. The same subjects will be used for a number of studies, data will be shared and several researchers are involved in more than one project. The collaboration between cognitive psychologists, sociologists and gerontologists is a particular strength.

Two industrial partners are directly involved with the network. They are the Aging and Rehabilitation Product Development Centre and the Corporate Health Consultants. Several other industrial and public sector partners have agreed to support and collaborate with the network and an industrial and service sector network will be developed.

The relevance

The subject is important given that one Canadian in four will be over 65 by the year 2031.

The proposed research can contribute directly to the development of new products and employee assistance programs. It could also result in cost savings to health care delivery systems.

The direct involvement of the product development centre and of a private sector company specializing in employee assistance programs ensures the transfer of information from the research.

The administrative and management capability

The proposed management structure provides for a central "infrastructure" node, which will facilitate integration and collaboration of the three nodes.

There is a strong leadership and representatives from the private sector and a researcher not involved in the network will sit on the research committee. Modalities for redirecting funds if this is required have been included.

Recommendation

The International Peer Review Committee recommends funding of this application under the Networks of Centres of Excellence Program.

APPENDIX B

NETWORKS OF CENTRES OF EXCELLENCE PROGRAM
REPORT OF THE MINISTER'S ADVISORY COMMITTEE

The Networks of Centres of Excellence (NCE) Program is a pivotal $240 million federal experiment to determine whether in selected situations networks of outstanding research scientists and relevant industrial counterparts can be brought together to achieve internationally competitive groupings in scientific areas where there is outstanding potential for growth and in fields of economic development which may be of long term benefit to Canada. Both the networking feature and the industrial linkages are specific features of this "Centres of Excellence" program which aims to link university researchers horizontally across the country as well as to integrate them vertically with their scientific colleagues in industry and government laboratories.

The large volume of applications received from across Canada demonstrates that the academic and business communities have responded in a dynamic fashion to the opportunities posed by the NCE Program. Comments from participants have indicated the value of the NCE exercise in stimulating new scientific interactions with colleagues across Canada and with counterparts in industry. More than 4000 Canadian scientists were involved in the 158 applications submitted for peer review. These proposals involve many of Canada's most honoured scientists and promising young researchers.

The Advisory Committee on the Networks of Centres of Excellence (NCE) Program was established by the Minister of State (Science and Technology) to provide advice on the structure and timing of the selection process, to observe its operation and attest to its integrity, and to make final recommendations based on the outcome of the international peer review process. Advice on the selection process having already been given, the Advisory Committee is now reporting on the following issues.

1. Has the IPRC Recommended the Best Networks?

The Advisory Committee reviewed in detail each of the 16 proposals which the International Peer Review Committee (IPRC) identified as worthy of funding. The applications were assessed against all four selection criteria, including the excellence of the science, but special attention was paid to the networking, industrial relevance and management aspects of the proposals. The

information compiled by the NCE Program Directorate, including experts' reports, site visit analyses and letters of support from university, industry and government sources, was made available to the Advisory Committee members. Each case was studied by two members, reported to, and considered by the full Advisory Committee.

Based on its review, the Advisory Committee confirms that the applications on the IPRC's "must be funded" list were of outstanding calibre and appropriately rated by the IPRC. From the IPRC's "should be funded" category the Committee identified 3 proposals as particularly meritorious, and of equivalent calibre to some in the "must be funded" category. The 4 remaining proposals recommended by the IPRC were not as strong in relation to one or more selection criteria and would require significant improvements which the Committee believes could be achieved in the negotiation of research agreements. The government can be confident in selecting some of this latter group for funding if sufficient funds remain once the 12 outstanding proposals have been supported.

2. Has the Selection Process Been Properly Handled?

Having closely observed the selection process established and managed by the Granting Councils, the Advisory Committee can fully attest to its thoroughness and integrity. As noted above, the Committee confirmed the IPRC's lists of networks worthy of funding. The Committee also audited an appropriate sample of those applications not recommended for funding by the IPRC, and in every instance it was apparent that there was a clear rationale for rejecting the application. On the basis of these reviews, the Advisory Committee has no hesitation in counselling the government to place complete confidence in the results of the international peer review process.

In examining the applications which have been set aside by the IPRC, the Advisory Committee observed that some involved excellent shorter term applied research which could have an earlier economic impact and which in some instances might be industry based. The proponents should be strongly urged to continue their endeavours and to seek funding from other channels such as the existing programs of Industry, Science and Technology Canada, the Atlantic Opportunities Agency, Western Economic Diversification Canada, the National Research Council, the Granting Councils and other science-based departments and through contributions from provincial governments and industry. As a first step in this process the Advisory Committee has established a sub-committee to determine

those applications which offer the greatest promise in terms of promoting Canadian industrial development through medium-term applied R&D. This list will be brought to the government's attention as soon as possible.

3. How Should Program Implementation Proceed?

In examining the plans of the networks being recommended for funding, the Advisory Committee concluded that certain improvements should be made which would foster a more effective achievement of the NCE Program objectives. In particular, the Committee was concerned about the issues of industrial linkages and technology transfer; intellectual property; network management; research integration; evaluation benchmarks and budgets. Accordingly, the potential improvements have been identified which should be pursued in the negotiations of the final research agreements and funding arrangements.

To develop the research agreements and funding arrangements with each network and ensure a consistent approach during the negotiation and implementation process, the Committee believes that a chief negotiator should be appointed and supported by a small team of experts from within and outside the Councils. This process would be expedited by having continuity and consistency of expertise from the selection phase of the Program. The Committee believes that Stuart Smith, as Chairman of the IPRC, would be an appropriate choice. The chief negotiator should present his report on the content of the research agreements and funding arrangements to the Granting Councils, which will refer them to the Minister of State (Science and Technology) prior to their being signed.

The success and efficiency of the selection process is due in no small measure to the effective coordination which has been established by the Granting Councils. This feature of the Program will be equally important during the implementation and evaluation phases. The Advisory Committee is therefore of the view that the Inter-Council Program Directorate and the Tri-Council Steering Committee, which includes a representative from Industry, Science and Technology Canada, should continue for the duration of the Program.

Final Recommendations

- That the following twelve networks, selected from the sixteen recommended for funding by the IPRC, and listed alphabetically, be funded on a priority basis:

- o Bacterial Diseases: Molecular Strategies for the Study and Control of Bacterial Pathogens of Humans, Animals, Fish and Plants;
- o Biotechnology for Insect Pest Management;
- o Canadian Network for Research on High Temperature Superconductivity;
- o Centre of Excellence for Molecular and Interfacial Dynamics;
- o Genetic Basis of Human Disease: Innovations for Health Care;
- o Institute for Telecommunications Research;
- o Institute for Robotics and Intelligent Systems - IRIS;
- o Microelectronics Devices, Circuits and Systems for Ultra Large Scale Integration-ULSI;
- o Neural Regeneration and Functional Recovery;
- o Ocean Production Enhancement Network;
- o Protein Engineering: 3D Structure, Function and Design; and
- o Science and Engineering for High-Value Papers from Mechanical Wood-Pulps.

- That the remaining program funds be expended on one or more of the following, alphabetically listed, networks which were also recommended for funding by the IPRC:
  - o Bétons à haute performance;
  - o Canadian Network for Space Research;
  - o Promoting Indepedence and Productivity in an Aging Society; and
  - o Respiratory Health Network of Centres of Excellence.
- That a chief negotiator be appointed, supported by a team of experts from within and outside the Granting Councils, to develop appropriate research agreements and funding arrangements for consideration by the Granting Councils and the Minister of State (Science and Technology) taking into account the improvements identified in the "Notes to the Negotiator";

- That the Minister of State (Science and Technology) coordinate an effort aimed at funding certain of the "not recommended" proposals, which will be identified by the Advisory Committee due to their substantial industrial benefits flowing from short and medium term applied research and their potential for strengthening industry-based R & D in Canada;

- That the Granting Councils maintain the Inter-Council Program Directorate and Tri-Council Steering Committee for the duration of the Program; and

- That an annual report on the Program's implementation be provided to the Minister of State (Science and Technology) by the Tri-Council Steering Committee.

Dr. John Evans, Chairman
President,
Allelix Inc.

Dr. Gilles Cloutier,
Vice-Chairman
Recteur,
Université de Montréal

BIOGRAPHIES

JOHN EVANS is the Chairman of the Board of Allelix Group Technologies Incorporated and A.D.I. Diagnostics Incorporated. He is also the Chairman of the Board of Trustees of the Rockefeller Foundation .

Dr. Evans was born in Toronto and received his M.D. from the University of Toronto. He was awarded his D.Phil from Oxford where he attended as a Rhodes Scholar. He was the Founding Dean of the McMaster Medical School and served as Vice President of Health Sciences from 1967-72. Dr. Evans was President of the University of Toronto from 1972-78. He served as Director of Population, Health and Nutrition Department of the World Bank from 1979-1983.

Dr. Evans has served on numerous commissions and committees in Canada and internationally. These include Chairmanship of the National Biotechnology Advisory Committee of Canada.

GILLES CLOUTIER is the Rector of the University of Montreal. He also serves as a Member of the Board of Directors of a number of university and science councils including the Association of Universities and Colleges of Canada and the Corporate-Higher Education Forum.

Dr. Cloutier was born in Quebec and received his Bachelor of Arts and Bachelor of Applied Sciences from Université Laval and his Masters and Doctorate degrees in Physics from McGill University. He has worked in the private sector as senior research officer with RCA Victor and as manager of the basic research laboratory of the Institute of Research of Hydro-Quebec and in academia as professor of Physics at the Université de Montréal. Dr. Cloutier was president of the Alberta Research Council from 1978-83.

In 1976, Dr. Cloutier received the Prix scientifique de la Province de Québec and was elected as a Member of the Royal society of Canada. He was named an Officer of the Order of Canada in 1981 and an Officer of the Order of Québec in 1989. He has received honourary degrees from four universities.

PIERRE BOIS is the President of the Medical Research Council of Canada.(MRC). Dr. Bois received his Bachelor of Arts degree from Laval University and his M.D. and Ph.D.in experimental medicine from the University of Montreal. He held a number of teaching appointments 1953 and 1970, and was Dean of the Faculty of Medicine at the Université de Montréal from 1970 to 1981..

Dr. Bois is a Fellow of both the Royal Society of Canada and the Royal College of Physicians and Surgeons of Canada. He is a Member of numerous scientific societies in Canada, the United States and France.

Dr. Bois has authored or co-authored more than 130 medical research publications. Dr. Bois has received honourary degrees from the Universities of Ottawa, Manitoba, and Sherbrooke.

IVAN DUVAR is the President and Chief Executive Officer of the Maritime Telegraph and Telephone Company Limited. He is also a Director of several Canadian companies including Telecom Canada, and a director of the Izaak Walton Killam Hospital Foundation, and the Halifax Industrial Commission.

Mr. Duvar was born in Prince Edward Island and received his Bachelor's degree in Electrical Engineering from the Technical University of Nova Scotia. He also holds a Certificate in Industrial Management from the Canadian Institute of Management.

Mr. Duvar is a Member of the Institute of Electrical and Electronic Engineers, the Association of Professional Engineers of Nova Scotia and the Canadian Institute of Management. He is the past president of the Halifax Board of Trade.

MICHEL GERVAIS is the Rector of the University of Laval.

Dr. Gervais studied Classics at the College de Levis, and Philosophy and Theology at Université Laval and in Rome where he received his Doctorate.

Dr. Gervais has served in a number of academic and administrative posts at Université Laval. He was the Director of "Projet Laval", an exhaustive review of Laval's academic and future directions.

Dr. Gervais has also participated on a number of commissions and studies including the University Council Commission on Higher Education, the Quebec Council of Universities, and the Social Sciences and Humanities Research Council (SSHRC).

GERALDINE KENNEY-WALLACE is the Chairman of the Science Council of Canada. She is a member of both the National Advisory Board on Science and Technology and the Ontario Premier's Council on Science and Technology, as well as the National Round Table on the Environment and the Economy.

A native of London, England, Dr. Kenney-Wallace was educated in Oxford and London, and received her M.Sc.and Ph.D. from the University of British Columbia, has six honorary degrees, and was E.W.R. Steacie Fellow 1984-86.

Dr. Kenney-Wallace is a noted international authority on lasers and optoelectronics and the author of over ninety research publications. The Royal Society of Chemistry (U.K.), the Guggenheim and Sloan Foundations (U.S.A.) and the Chemical Institute of Canada have honoured her work.

PAULE LEDUC is the President of the Social Sciences and Humanities Research Council (SSHRC).

A native of Quebec, Dr. Leduc holds a Bachelor of Arts and a Bachelor of Pedagogy from the University of Sherbrooke , a Masters degree in literature from the University of Montreal, and a Doctorate of literature from the University of Paris.

Dr.Leduc taught at Loyola College, McGill University ,the University of Montreal, and the University of Quebec in Montreal from 1966-1972. Since 1972, Dr.Leduc has held a number of administrative positions in both the university and public sectors. She served as President of the Council of Universities from 1977-1981,as Deputy Minister in the Quebec Department of Intergovernmental Affairs from 1982-84, and Deputy Minister of Cultural Affairs from 1984-1986.

WALTER LIGHT is on the Board of Directors of eleven companies including Northern Telecom, Shell Canada Limited, and Procter & Gamble. In addition, he is a Counsellor of the C.D. Howe Institute, a Governor of the Montreal Museum of Fine Arts, and Chairman of the Board of Trustees at Queen's University. Mr. Light is a retired Chairman of Northern Telecom Limited.

Mr. Light joined the Royal Canadian Air Force in 1942. Following his service overseas, Mr. Light received his Bachelor of Science degree in 1949. Mr. Light is a Fellow of the Engineering Institute of Canada, and a Fellow of The Canadian Academy of Engineering.

Mr. Light was the Chairman of the International Trade Advisory Committee (ITAC) from 1985-1988. In December of 1986, Mr. Light was appointed an Officer of the Order of Canada, and in March, 1988 he was awarded the Order of Ontario. Six Canadian universities have conferred Honorary degrees upon Mr.Light.

JOHN MACDONALD is the Chairman of the Board of MacDonald Dettwiler and Associates, Limited. He currently serves as a member of the Premier's Advisory Council on Science and Technology for British Columbia, as well as a member of the National Advisory Board on Science and Technology (NABST).

Dr. MacDonald received his Bachelor's degree in electrical engineering from the University of British Columbia and both his Masters Degree and Ph.D. from the Massachusetts Institute of Technology . Dr. MacDonald is a Senior Member of the Institute of Electrical and Electronic Engineers, a Fellow of the Canadian Aeronautics and Space Institute and a member of the International Neural Network Society.In January of 1989, Dr. MacDonald was appointed an Officer of the Order of Canada.

Dr. MacDonald's research interests include advanced digital systems engineering, remote sensing, image processing, machine vision, and the applications of remote sensing with particular emphasis on data handling techniques.

ARTHUR MAY is the President of the Natural Sciences and Engineering Research Council (NSERC). Dr. May was born in Newfoundland and received both his Bachelor and Master of Science degrees from Memorial University of Newfoundland. He was awarded his doctorate in Marine Studies from McGill university .

Dr. May was employed as a research scientist at the Newfoundland Biological Station from 1958-71. Dr. May was seconded to Ottawa from 1971-73 to develop the Canadian fisheries position for the Law of the Sea. He held a variety of positions with the department of Fisheries and Oceans including that of Deputy Minister from 1981-1986.

Dr. May has served on a number of international bodies including the Canada-Norway Seal Commission and,the North Atlantic Salmon Conservation Organization. He was President of the Northwest Atlantic Fisheries Organization from 1979-81. Dr. May was awarded an honourary Doctorate from the University of Ottawa in 1988, and from Memorial University of Newfoundland in 1989.

FRASER MUSTARD is the founder and President of the Canadian Institute for Advanced Research (CIAR). He is a member of the Premier's Council on Science and Technology, and the Premier's Council on Health in Ontario, and a member and Vice-chairman of the National Advisory Board on Science and Technology (NABST).

Dr. Mustard received his M.D. from the University of Toronto in 1953, and his Ph.D. from Cambridge University three years later. In 1966 he helped to establish the medical school at McMaster University . Dr. Mustard is recognized as one of the pioneers in studying the role of platelets in atherosclerosis, thrombosis and hemostasis.

For his contributions to medical research, medical education and his work on government councils, commissions and task forces, Dr. Mustard was made an Officer of the Order of Canada in 1986. Five Canadian universities have also recognized these contributions by awarding Dr. Mustard honourary degrees.

MARY SPENCER is University Professor in the Department of Plant Science at the University of Alberta in Edmonton. Dr. Spencer, a native of Regina, graduated from the University of Saskatchewan in Chemistry, received her Masters degree from Bryn Mawr College in Pennsylvania and her Ph.D. from the University of California in Berkeley. Her early experience was with Ayerst, McKenna and Harrison Limited, in Montreal, the National Canners Association in San Francisco, and as a member of the academic staff at the University of California, Berkeley.

Dr. Spencer has served on the Board of the Natural Sciences and Engineering Research Council of Canada (1986-89), the Natural Research Council (1970-76) and the Board of Governors of the University of Alberta (1976-79). Dr. Spencer was named a Fellow of the Chemical Institute of Canada (1966) and a Fellow of the Royal Society of Canada (1976), and University Professor (1984).

Dr. Spencer's main research interest is in plant biochemistry, with emphasis on ethylene metabolism and alternative mechanisms of respiration.

IHOR SUCHOVERSKY was Vice President, Research and Technology, Alcan Aluminium Limited and President,Alcan International Limited Montreal until August 1989 when he retired from Alcan. He is a Director of Spar Aerospace Limited, and Alcan Deutschland GmbH.

Born in the Ukraine, Mr. Suchoversky was educated at the Institute of Technology, Munich, Louvain University, Belgium, and received a Masters Degree in mechanical and aeronautical engineering from the Federal Institute of Technology in Zurich. He joined Alcan in 1952 at Rorschach, Switzerland and has worked in various divisions and locations within the corporation, both in technical and managerial positions.

Mr. Suchoversky is a Member of the Institute of Aeronautical Sciences and the Association of Professional Engineers of Ontario.